TAPHONOMY AND PRESERVATION POTENTIAL OF SPONGE TISSUE. *Memoirs of the Queensland Museum 44: 516. 1999*:- The preservation potential of sponge tissues is mainly controlled by sponge related bacteria (Reitner, 1993; Reitner & Neuweiler, 1995). *In situ* hybridization of the associated microbial populations in few modern demosponges (*Petrosia, Chondrosia*) showed that the majority of bacteria are members of the gamma-subclass of Proteobacteria (Schumann-Kindel et al., 1996, 1997). Using highly specific oligonucleotide probes for detecting sulfate-reducing bacteria, distinct signals were found scattered in native sponge tissue of both investigated sponges. Also, other fermentative bacteria are involved in the degradation of sponge tissue. Sulfate reducing bacteria may control the calcification of the sponge tissue during degradation, increasing the carbonate alkalinity (Schumann-Kindel et al., 1997; Reitner & Schumann-Kindel, 1997). Therefore, isolated pyrite crystals are common in mineralized (automicritic) sponges tissues. In the surrounding sediment, pyrite is absent or rare. The sponge tissue automicrites are often dark-coloured due to statistically distributed very fine pyrite crystals (ca. 1µm diameter). Besides the small pyrite, larger crystals often exhibit patchy concentrations or they are arranged in rows. Pyrite formation is probably linked with sulfate reducing symbiotic bacteria in the sponge mesohyle. During early decaying processes of the sponge tissue the internal sponge space becomes entirely anaerobic which favours the growth of the sulfate reducing bacteria.

This process may explain the rapid calcification of sponge tissue in modern marine microbialites and ancient sponge mud mounds. In mud mounds siliceous sponges contribute to buildup development with considerable amounts of sponge body-related micrite produced in place. These sponge container automicrites form during the biodegradation of soft tissues, resulting in various 'classical' microbial fabrics. The initial formation of carbonate crystals is controlled by reactive organic compounds (macromolecules) during conditions of elevated carbonate alkalinity (ammonification) (Reitner, 1993; Reitner et al., 1995). The resulting carbonate microfabrics correlate with different soft tissue precursors (mesohyle). The mesohyle structure varies from: bacteria-containing (minipeloidal); bacteria-bearing, rich in choanocyte chambers (peloidal); to bacteria-poor or syncytial structures (aphanites). Intermediate reactive states of organic matter also lead to the *in situ* preservation of non-rigid demosponges, which are recognized by spicular architecture, spatially restricted occurrences of unsorted spicules, or even by spicule bearing minipeloids, peloids or aphanites. Principally non-spicule bearing sponges should be recognized by the outer (e.g. nodular) shape of microbial fabrics. Organically induced automicrites (organomicrites) are high-Mg calcites with an inorganic signature of $\delta^{13}C$ (+3 to +4). The enhanced identification of an autochthonous sponge fauna within mud mounds provides new insight into the nature and origin of these structures. Semi-quantitive data of Cretaceous mounds reveal that 50-80% of mound micrites were produced in place from which up to 60% of automicrites can be related to metazoans. Therefore, the origin of reactive organic matter is the crucial point to evaluate the pure microbial vs metazoan character of Paleozoic and Mesozoic mud mounds, as well as Precambrian micrites within biostromal and biohermal deposits (Reitner & Arp, 1999). ❐ *Porifera, mud-mounds, micrites.*

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Joachim Reitner (email: jreitne@gwdg.de) & Fritz Neuweiler, Institut und Museum für Geologie und Paläontologie, Univ.Göttingen, Goldschmidtstr.3, D-37077 Göttingen, Germany; Gabriela Schumann-Kindel, Ökologie der Mikroorganismen, Technische Universität Berlin, Franklinstr.29, D-10587 Berlin, Germany; Volker Thiel, Institute of Biogeochemistry and Marine Chemistry, Univ. Hamburg, Bundesstr.55, 20146 Hamburg, Germany; 1 June 1998.